CLAIMS

1. Device for the three-dimensional recording of a scene (4), comprising a laser emitter (20), means (14, 42, 200, 202, 204, 206, 210, 212, 224, 226) for scanning along first and second rotation axes (16, 44) in order to scan the scene (4) using a laser beam emitted by the laser emitter (20), a photosensitive receiver (46) for receiving an image of a spot (52) created by the laser beam on the scene (4), means (38, 50) for focussing the laser beam backscattered by the scene (4) towards the photosensitive receiver (46), first measuring means (214, 226) for measuring the orientation of the beam leaving the scanning means (14, 42, 200, 202, 204, 206, 210, 212, 224, 226) and second measuring means (24, 28, 32, 34, 48, 314) for measuring the distance between the device and the spot by laser telemetry, the said second measuring means comprising a splitter plate (32) for splitting the emitted beam and the beam backscattered by the scene (4), characterized in that the focussing means (38, 50) comprise a convergent optical system (38) combined with a divergent optical system (50) for increasing the focal length of the convergent optical system, thus forming a teleobjective, and in that the scanning means (14, 42, 200, 202, 204, 206, 210, 212, 224, 226) include at least one mirror (42) placed in the path of the emitted and backscattered laser beams between the focussing means (38, 50) and the scene (4).

2. Three-dimensional recording device according to Claim 1, characterized in that the convergent optical system (38) comprises a spherical mirror for compensating for deformations of the wave surface of the beam which are caused by the splitter plate (32), this optical mirror being placed off-axis with respect to the emitted and backscattered laser beam.

3. Three-dimensional recording device according to Claim 1 or 2, characterized in that the second measuring means comprise, placed between the laser emitter (20) and the splitter plate (32), a prismatic plate (24) for compensating for the deformations of the wave surface of the emitted beam which are caused by the off-axis spherical mirror (38).

4. Three-dimensional recording device according to Claim 3, the second measuring means of which furthermore comprise means (24, 28, 314) for measuring the instant the laser beam is emitted and means (48, 314) for measuring the instant the beam backscattered by the scene (4) is received by the photosensitive receiver (46), characterized in that the means for measuring the instant the laser beam is emitted comprise an optical fibre (28) which receives part of the off-axis laser beam reflected by the prismatic plate (24) and transmits it to a photosensitive receiver (29).

5. Three-dimensional recording device according to any one of Claims 1 to 4, characterized in that the divergent optical system (50) comprises a divergent lens placed in the path of the backscattered beam between the splitter plate (32) and the photosensitive receiver (46).

6. Three-dimensional recording device according to any one of Claims 1 to 5, characterized in that the splitter plate (32) has a semireflective patch (34) for reducing the dynamic range of the power of the laser beam backscattered by the scene (4) and received by the photosensitive receiver (46).

7. Three-dimensional recording device according to any one of Claims 1 to 6, characterized in that the photosensitive receiver (46) comprises an avalanche

photodiode and in that this photodiode is combined with temperature compensation means (330).

8. Three-dimensional recording device according to Claim 7, characterized in that the temperature compensation means (330) comprise a temperature probe (316) and are means for adjusting the bias voltage of the photosensitive receiver (46) according to the temperature measured by this probe (316).

9. Three-dimensional recording device according to any one of Claims 1 to 8, characterized in that the scanning means (14, 42, 200, 202, 204, 206, 210, 212, 224, 226) comprise a plane mirror (42) and means (14, 200, 202, 206, 224, 226) for controlling the position of this mirror about each of the said first and second rotation axes (16, 44) of the said scanning means.

10. Three-dimensional recording device according to Claim 9, comprising an optomechanical part (10) and an electronic part (12), characterized in that the first rotation axis (16) is a relative bearing rotation axis and in that the means (14, 200, 202, 206) for controlling the position about this axis comprise a platform (14) driven in rotation about this axis by a stepper motor (200) and pierced by an axial opening (18) for the passage of electrical connection means (18a) for connection between elements of the optomechanical part (10) and elements of the electronic part (12).

11. Three-dimensional recording device according to Claim 10, characterized in that the platform (14) is placed on a stationary ring (204) via bead-mounted ball bearing means (212) placed between the platform (14) and the stationary ring (204).

12. Three-dimensional recording device according to Claim 11, characterized in that the stepper motor (200)

is placed beneath the stationary ring (204) on the periphery thereof and is linked to a gearwheel (206) for rotating the platform (14) about the first axis (16) via a cogged belt (210) carried by the platform (14).

13. Three-dimensional recording device according to any one of Claims 9 to 12, characterized in that the second rotation axis (44) is an elevation rotation axis and in that the means (224, 226) for controlling the position about this axis include a drive shaft (224), the axis of which is fixed with respect to the platform (14), connecting the mirror (42) to a galvanometric scanner (226) driving the mirror (42) in rotation about the said second axis (44).

14. Three-dimensional recording device according to any one of Claims 10 to 13, characterized in that the first measuring means (214, 226) comprise an annular incremental optical encoder (214) for measuring the relative bearing orientation of the beam, the encoder being carried by the platform (14).

15. Three-dimensional recording device according to Claim 14, characterized in that the optical encoder (214) is fastened to the stationary ring (204) and is provided with a movable part (222) fastened to the platform (14).

16. Three-dimensional recording device according to any one of Claims 1 to 15, characterized in that it furthermore includes a unit (22) for automatically focussing the laser beam emitted by the laser emitter (20) and means (96, 98, 100, 108) for fixing the laser emitter (20) to the unit (22).

17. Three-dimensional recording device according to Claim 16, characterized in that the said fixing means (96, 98, 100, 108) comprise a baseplate (96) carrying

the laser emitter (20) and fixed to the automatic focussing unit (22) by means of screws (100) engaged in axial holes (102) of larger diameter which are made in the baseplate (96), and screws (106) for the radial adjustment of the laser emitter (20) with respect to the automatic focussing unit (22).

18. Three-dimensional recording device according to either of Claims 16 and 17, characterized in that the unit (22) for automatically focussing the laser beam comprises at least one divergent lens (60, 62) placed on the emission axis (26) of the laser beam, a convergent lens (64) also placed on the emission axis (26) and means (78, 118, 120, 122, 124, 126, 128, 130) for the relative travel of the convergent lens (64) and of the divergent lens (60, 62) along the emission axis (26).

19. Three-dimensional recording device according to Claim 18, characterized in that the said relative travel means (78, 118, 120, 122, 124, 126, 128, 130) comprise a sleeve (78) supporting the convergent lens (64), around which sleeve a flexible membrane (120) is fixed, and means (118, 124, 126, 128, 130) for actuating the membrane (120) for the purpose of making the said sleeve (78) travel along the emission axis (26).

20. Three-dimensional recording device according to Claim 19, characterized in that the means (118, 124, 126, 128, 130) for actuating the flexible membrane (120) comprise a current generator (124) and a coil (118) which is fed with current by the current generator (124), is fixed to the flexible membrane (120) and is placed in the gap of a magnetic core (112), around the emission axis (26).

21. Three-dimensional recording device according to Claim 19 or 20, characterized in that the means (118,

124, 126, 128, 130) for actuating the flexible membrane (120) comprise means (126) for comparing the detected position of the convergent lens (64) with the desired position of the convergent lens (64) along the emission axis (26), including means for actuating the current generator (124) depending on this difference.

22. Three-dimensional recording device according to any one of Claims 16 to 21, characterized in that the automatic focussing unit (22) includes optical means (128, 130) for detecting the position of the convergent lens (64) along the emission axis (26).

23. Three-dimensional recording device according to any one of Claims 9 to 22, characterized in that it includes means of adjustment (228) of the means for controlling the position of the galvanometer mirror (42) about the elevation rotation axis (44) and means of adjustment (229) of the axis (36), along which the laser beam is received, about the bearing rotation axis (16).

24. Three-dimensional recording device according to Claim 23, characterized in that the means of adjustment (228) of the means for controlling the position of the galvanometer mirror (42) and the means of adjustment (229) of the axis (36) along which the beam is received each comprise a cradle (230, 234) formed from a portion of a ring and each comprise a corresponding cradle support (232, 236) in which the cradle slides so as to rotate about the axis of the said ring.

25. Three-dimensional recording device according to Claim 24, characterized in that the rotation axis of the cradle (230) of the means of adjustment (228) of the means for controlling the position of the galvanometer mirror is perpendicular to the elevation rotation axis (44) and to the relative bearing rotation axis (16) and in that the rotation axis of the cradle

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(234) of the means of adjustment (229) of the reception axis (36) is perpendicular to the elevation rotation axis (44) and lies in a vertical plane containing the bearing rotation axis (16), the said rotation axes of the cradles (230, 234) intersecting at the centre of the mirror (42).

26. Three-dimensional recording device according to any one of Claims 1 to 25, characterized in that it furthermore includes means (300) for reducing the dynamic range of the signal delivered as output by the photosensitive receiver (46).

27. Three-dimensional recording device according to Claim 26, characterized in that the means (300) for reducing the dynamic range of the signal comprise a voltage attenuator (304) with a programmable gain and an amplification unit (308) having a fixed gain on the output side of this attenuator (304).

28. Three-dimensional recording device according to any one of Claims 1 to 27, characterized in that the second measuring means (24, 28, 32, 34, 48, 314) for measuring the distance between the device and the spot comprise an integrated circuit (314) for measuring the "time of flight" of the laser beam.

29. Method for designating an area of interest on a scene (4) carried out in a three-dimensional recording device according to any one of Claims 1 to 28, comprising the following steps:

- three-dimensional recording of a cloud of points of the scene (4);
- storage (12) of the coordinates of the cloud of points recorded;
- modelling and/or display of the said cloud of points;

characterized in that it furthermore includes the following steps:

- selection of a subcloud of at least one point in the said cloud, defining the said area of interest; and
- control of the scanning means (14, 42, 200, 202, 204, 206, 210, 212, 224, 226) and of the emitter (20) so that the spot (52) created on the scene (4) by the laser beam designates in succession at least some of the points of the selected subcloud corresponding to the said area of interest.